



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 10/642,615      | 08/19/2003  | Ali Afzali-Ardakani  | YOR920030023US1     | 3761             |

48150 7590 09/07/2006

MCGINN INTELLECTUAL PROPERTY LAW GROUP, PLLC  
8321 OLD COURTHOUSE ROAD  
SUITE 200  
VIENNA, VA 22182-3817

|                |
|----------------|
| EXAMINER       |
| GAKH, YELENA G |

|          |              |
|----------|--------------|
| ART UNIT | PAPER NUMBER |
| 1743     |              |

DATE MAILED: 09/07/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

10/642,615

Applicant(s)

AFZALI-ARDAKANI ET AL.

Examiner

Yelena G. Gakh, Ph.D.

Art Unit

1743

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 14 July 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-30 is/are pending in the application.
- 4a) Of the above claim(s) 20-30 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-19 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date 08/19/03.
- ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_.
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: \_\_\_\_\_.

### **DETAILED ACTION**

1. Election of claims 1-19 without traverse filed on 07/14/06 is acknowledged.

#### ***Specification***

2. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

The specification is objected to as being a description of the Applicants' hypothesis for a possible molecular manipulator based on known facts from the area of nanotechnology related to molecular tools. It does not appear that any of the proposed molecules has been synthesized and tested as claimed. The molecules depicted on Figures 1 and 2 are not CA registered (the library search report is attached) and obviously do not exist. The Applicants did not provide any possible synthetic path for obtaining such molecules, not mentioning their testing as molecular manipulators. The hypothesis is not experimentally proven.

#### ***Claim Rejections - 35 USC § 112***

3. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

4. Claims 1-19 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter, which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

#### ***The Breath of the Claims***

The claims recite in the most general terms "a molecule manipulator" comprising a light-sensitive molecule with a double bond, in particular azo-bond, which changes its configuration

Art Unit: 1743

upon light irradiation, with the molecule attached to the probe of a scanned-proximity probe microscope. No specifically synthesized molecules, which can act as molecular manipulators as recited in the claims, are disclosed in the specification. Two examples depicted on the pictures are not the real molecules. The specification does not provide any evidence for their synthesis or parameters.

### *The Nature of the Invention*

The invention is directed toward a hypothetical molecular manipulator based on a known fact of cis-trans light-induced transformation of azo-bond. The hypothetical molecules are attached to the tip of the atomic force microscope (AFM). Two molecules are depicted on Figures 1-2 as the examples. The molecules are not known in the literature and do not have CA registration numbers (the library search report is attached). They are not described in the specification as the known molecules; however, their synthesis is not provided either. It appears that the invention is totally hypothetical.

### *The State of the Prior Art*

The prior art is in the field of nanotechnology related to “molecular machines” or “molecular tools”. The examiner searched patent and non-patent literature pertinent to molecular tweezers, clips, manipulators, motors, etc. One of the most recent papers on molecular motors, “Molecular Motor Spins On Surface” by Netherlands chemists was proclaimed as the “first light-driven molecular rotary motor attached to a solid surface” (Chemical & Engineering News, 2005). Klärner et al. (Acc. Chem. Res., 2003) provide a detailed review of “Molecular Tweezers and Clips as Synthetic Receptors” with tweezers and clips containing naphthalene and benzene spacer units, which are synthesized by repetitive Diels-Alder reactions. The tweezers and clips should possess specific structural, thermodynamics and other physical-chemical requirements in order for such host-guest interaction to take place. Feringa et al. (Appl. Phys., 2002) describe “Light-driven molecular switches and motors” with detailed disclosing of physical-chemical properties of molecular motors comprising double bond, which undergoes light-induced cis-trans

Art Unit: 1743

transformation. Specific requirements should be fulfilled for the switches and motors to perform their functions. Jones et al. and Pearson et al. (J. Org. Chem., 1997) described in detail “Molecular scale wires with alligator clips” providing their full synthesis and physical-chemical characteristics. A series of papers is devoted to molecular devices based on light-induced cis-trans transformation of azo-bond in azobenzene moieties. Stiller et al. (Surface and Interface Analysis, 2000) teach “scanning Kelvin microscopy as a tool for visualization of optically induced molecular switching in azobenzene self assembling films”; Hugel et al. (Science, 2002) disclose “single-molecule optomechanical cycle” with a detailed study of molecular devices based on photosensitive azobenzene polymers. Muraoka et al. (J. Am. Chem. Soc., 2003) describe “light-driven open-close motion of chiral molecular scissors” based on azobenzene expansion and contraction (cis-trans transformation) of N=N bond. Jousseime et al. (J. Am. Chem. Soc., 2003) teach “photomechanical actuation and manipulation of the electronic properties of linear  $\pi$ -conjugated systems” using azobenzene chromophore. Wen et al. (J. Phys. Chem. B, 2005) teach “photochemical-controlled switching based on azobenzene monolayer modified silicon (III) surface”. Bellini et al. (J. Phys.:Condens. Matter, 2006) disclose “light-induced molecular motion of azobenzene-containing molecules: a random-walk model”. None of the recited papers indicate the possibility of using molecules recited in the claims and those depicted on Figures 1 and 2 as molecular manipulators; the examiner did not find any reference, which would disclose a synthesis of similar compounds. Moreover, the bulkiness of the cis-conformer of a hypothetical structure 1A would assume its high non-planarity, which may totally prevent its ability to grab molecules and be used as a molecular manipulator.

### *The Level of One of Ordinary Skill*

Synthesis of any of the hypothetical structures disclosed in the specification, including those depicted on Figures 1 and 2 and recited in the claims, are beyond the skill of a routineer in the art. Even in the case of successful synthesis of such structures after a rigorous experimentation, it is outside the scope of any routineer in the art to study these molecules in

Art Unit: 1743

relation to their ability to be molecular manipulators, as demonstrated by highly complex and detailed studies of molecular tools disclosed in the prior art.

***The Level of Predictability in the Art***

The prior art does not provide any ground for expecting success in synthesis of structures disclosed in the specification and their application as molecular manipulators.

***The Amount of Direction Provided by the Inventor***

The instant disclosure does not provide any direction as to how to synthesize at least some analogous of the compounds claimed to be molecular manipulators. Nor does it disclose any ways for determining if the synthesized molecules are capable of being molecular manipulators.

***The Existence of Working Examples***

No working examples are provided by the specification, not mentioning description of the synthesis of novel compounds.

***The Quantity of Experimentation Needed  
to Make or Use the Invention Based on the Content of the Disclosure***

It requires an enormous amount of experimentation to synthesize hypothetical compounds disclosed in the specification and study them as potential molecular manipulators.

5. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Art Unit: 1743

6. Claims 1-19 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 1 recites “a probe” to which the light-sensitive molecule is attached”. “A probe” is not a definite term of the art. It can be a chemical probe (for a target molecule). It can be a physical surface. The term “probe” renders the claim unclear and indefinite.

In claim 2 it is not quite clear, what is “a line” of a scanned-proximity probe microscope, and how can the light-sensitive molecule be attached to the line?

From claim 3 it is not apparent, if this is a tip of the probe, or “a line” (claim 2) made of the materials recited in the claim?

In claims 4 and 9 the examiner suggests changing the words “comprises” to “is” and “compound” to “molecule”, since “a molecule” cannot comprise “a compound”, and “a molecule” is “a molecule”.

In claim 5 it is not apparent as what is “a moiety located between the two arms”? Is this the central part of the molecule between two arms? Since the molecule is supposed to work as molecular tweezers, the claim can be interpreted as reciting the light-sensitive molecule holding the chemical moiety between its arms.

From claim 6 it is not apparent, if “other than an azo double bond” is a double bond “other than an azo double bond”, or it is not a double bond at all.

In claim 10 “*a* same” should be changed to “*the* same”.

It is further not apparent as to what is an azo double bond “comprising *a* same cis-trans configuration, when illuminated by the light of the selected wavelength”? This phrase does not make much sense. First, it is not clear as to how the double bond can possess (comprise) cis-trans configuration? It can possess either cis-, or trans-configuration. Also, it is not apparent as to why possessing cis-trans configuration depends on illuminating the double bond by the light? Double bonds always possess either cis- or trans-configuration, independent on any illumination with the light. If the claim was supposed to recite simultaneous *changes* in cis- or trans-configuration in both arms upon illuminating by the light, then this should be clearly recite in the claim.

In claims 12, 14 and 16 the correct recitation for the Markush group is: "wherein the functional group is selected from the group consisting of ...". Corresponding correction is required.

In claim 18 the examiner suggests changing the language to "wherein the two arms are of a different length".


Claim 19 appears to recite a method step. Moreover, since R is selected from different substituents, the space will inherently vary depending on the selected R. It is not apparent as to what specific structural limitation claim 19 is reciting.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Yelena G. Gakh, Ph.D. whose telephone number is (571) 272-1257. The examiner can normally be reached on 9:30 am - 6:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jill A. Warden can be reached on (571) 272-1267. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

8/31/06

  
**YELENA GAKH**  
**PRIMARY EXAMINER**